ETS and FuelEUMaritime

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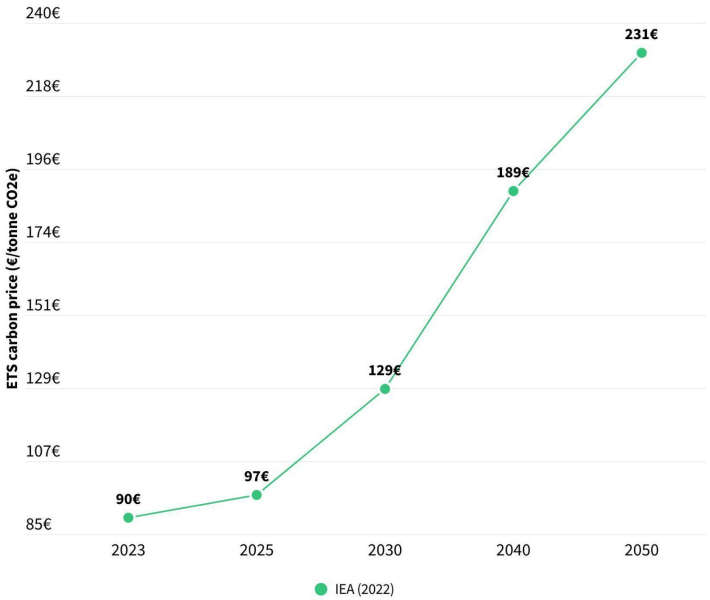
Projected evolution of ETS CO2e price

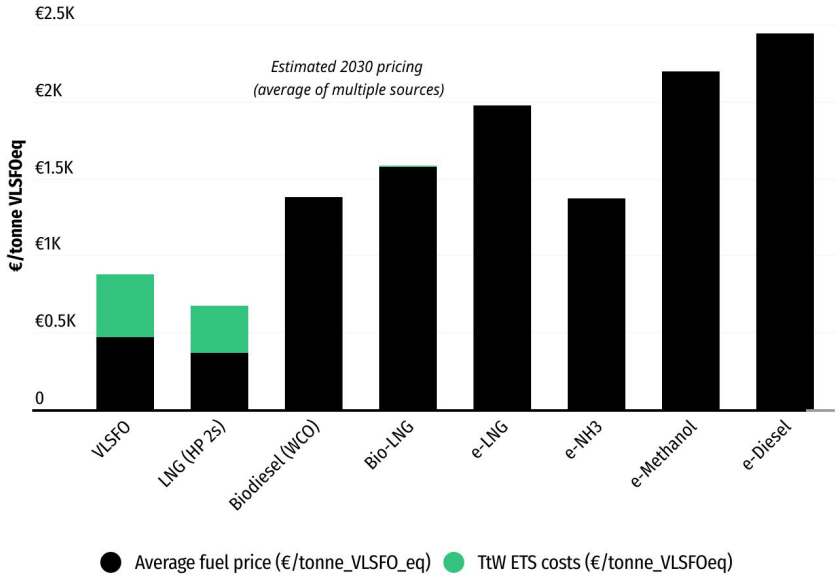


Source: based on the 'Advanced Economies: Net Zero Pledges' scenario in the IEA's World Energy Outlook (2022, original prices in USD)

	Regulated ship types	Phase-in	GHGs
2024	Cargo & passenger ships (5000+ GT)	40%	CO_2
2025		70%	
2026		100%	CO_2, CH_4, N_2O
2027	Cargo & passenger ships (5000+ GT) + Subject to legislative review: offshore vessels (5000+ GT) & cargo, and passenger ships (400+ GT)	100%	

T&E briefing on maritime ETS:
https://www.transportenvironment.org/wp-content/uploads/2023/02/ETS-Explainer-Briefing-2022-02-1.pdf

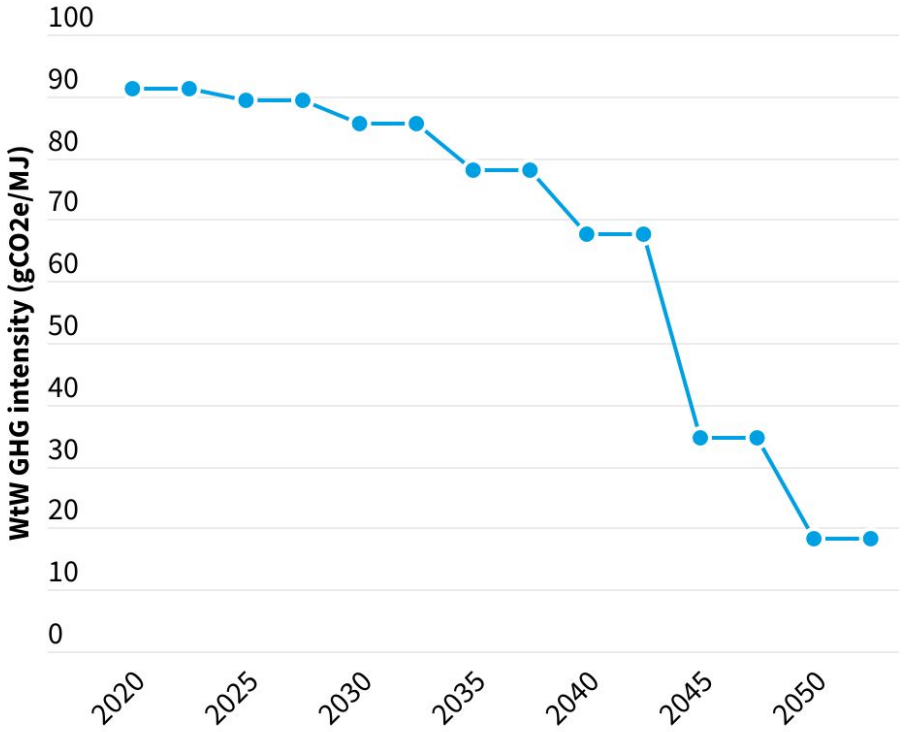
Carbon pricing and competitiveness of alternative marine fuels



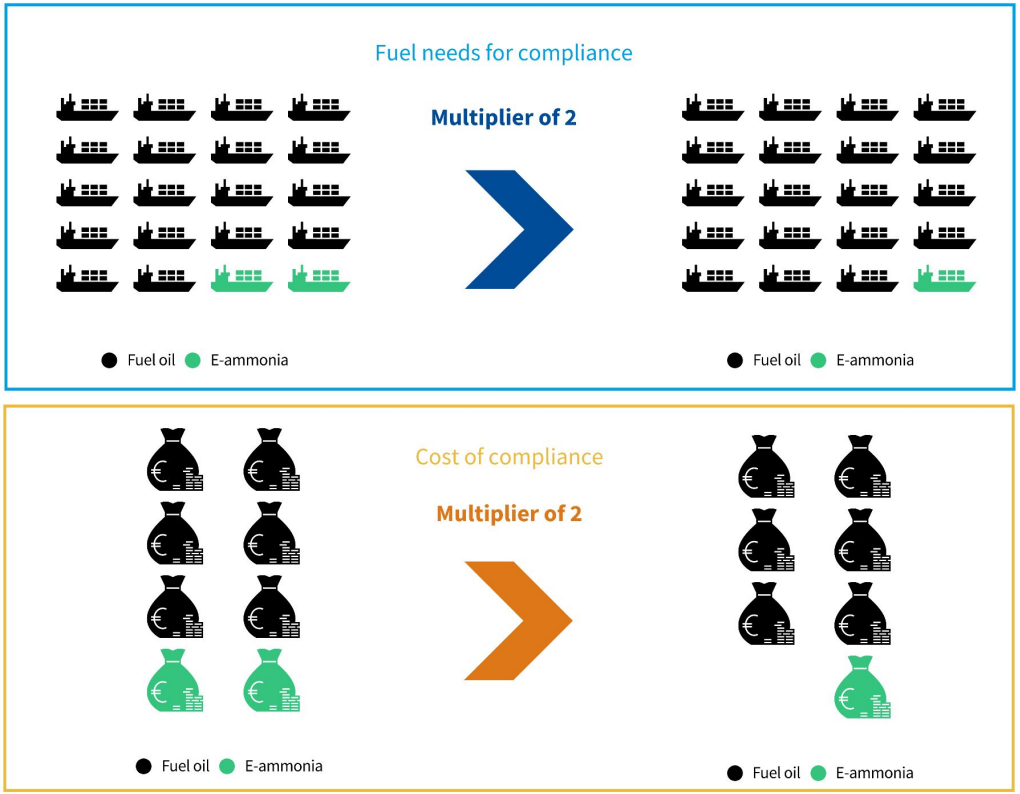
Source: Transport & Environment (2023). Modelling The Impact Of FuelEU Maritime On EU Shipping. Analysis assumes €130/tonne_CO2e TtW carbon pricing.

Sustainable and scalable marine fuels are still too **expensive** (2030) even after **€130/tonne** TtW CO2e carbon pricing

Regulatory targets set by FuelEU Maritime



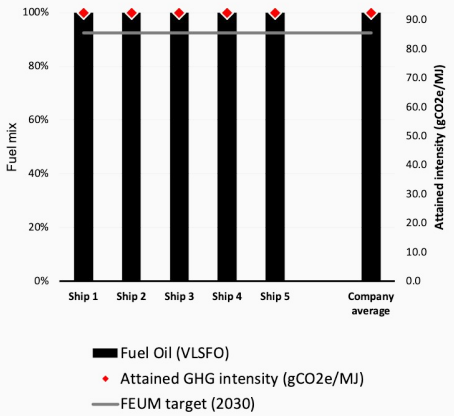
FEUM	Reduction targets	GHG thresholds (gCO2e/MJ)
2020 baseline		91.16
2025-2029	-2%	89.34
2030-2034	-6%	85.69
2035-2039	-14.5%	77.94
2040-2044	-31%	62.90
2045-2049	-62%	34.64
2050+	80%	18.23



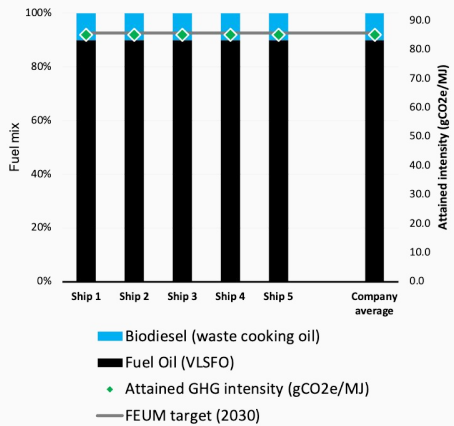
EU adopted a multiplier 2 for green e-fuels

Compliance strategies: Which is the most cost-effective?

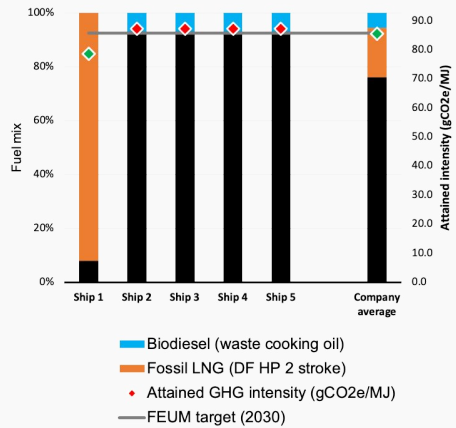
2020 baseline



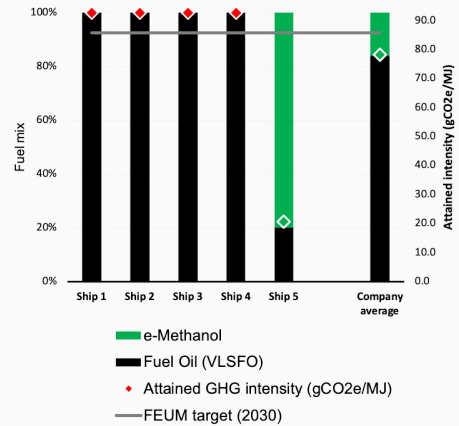
Ship-level compliance 2030 (scenario 1)



Pooled compliance 2030 (scenario 2)

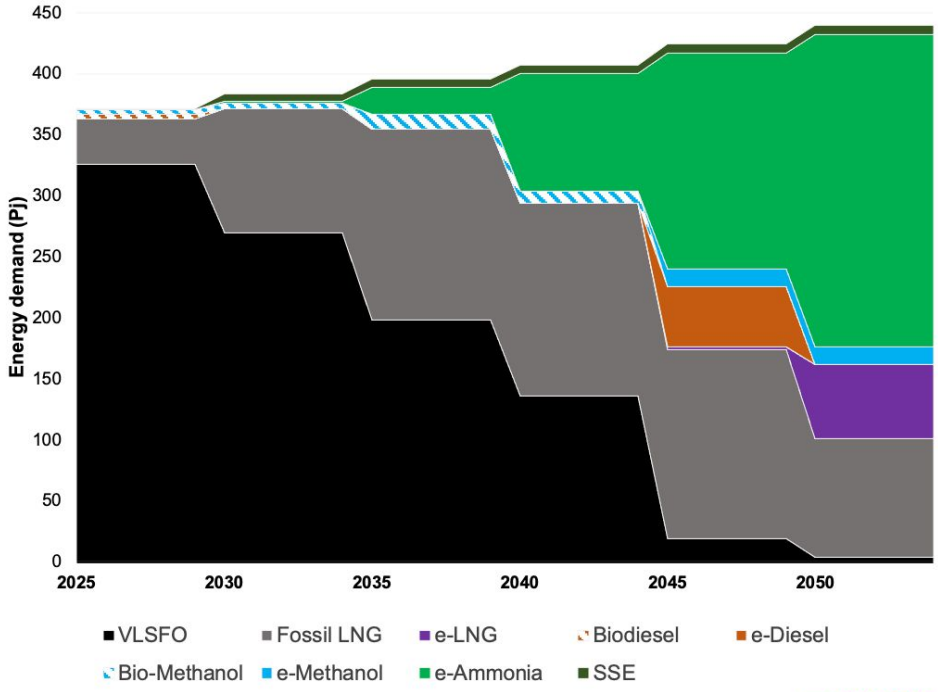


Pooled compliance 2030 (scenario 3)



Projected fuel mix for container fleet

FuelEU Maritime positive, but allows fossil fuel use into the 2050s



Source: T&E containership fuel optimisation model (2023). FEUM pathway, base-case.

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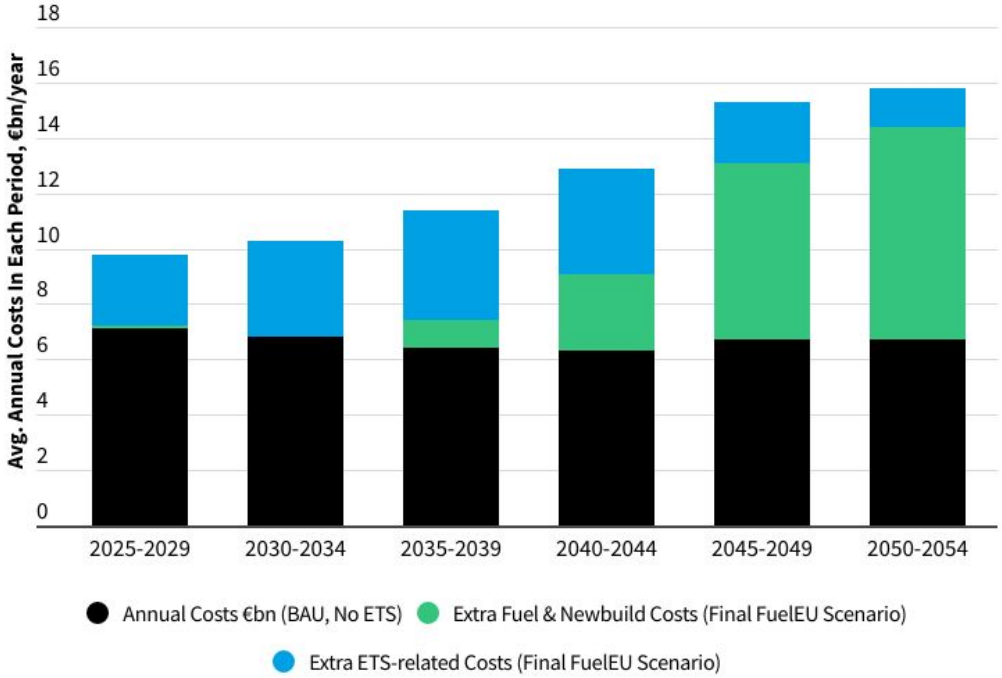
Base-case fuel prices

- FuelEU still allows ships to burn fossil VLSFO & LNG into the 2050s.
- If technically feasible, e-Ammonia likely to see the biggest demand from new ships from 2040 onwards.
- Limited demand for biofuels if competition from other sectors and limited scalability result in higher prices.
- LNG still the main option for early switching given relatively weak FEUM targets in the early years.

Projected FF55 Costs For Container Shipping: ETS Is Greater Share Until 2045

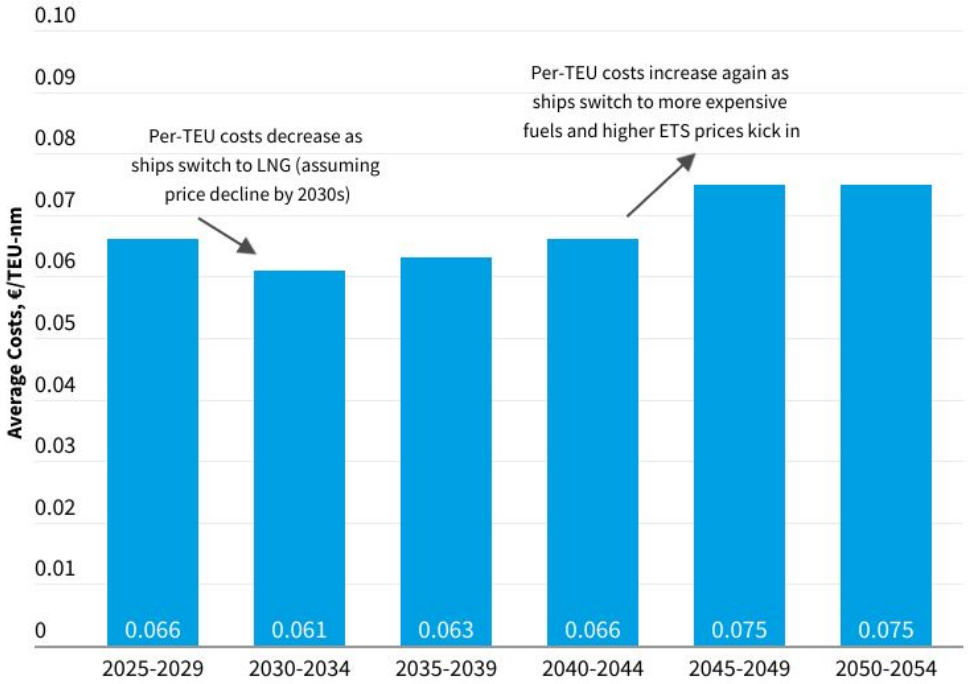


Source: T&E containership fuel optimisation model (2023). **Note**: costs do not include required investments in energy efficiency technologies, non-machinery OPEX, or other costs.

Final FEUM pathway

- The modelling also allows us to look at additional fuel and newbuild costs implied by the regulation.
- Both ETS and FuelEU will have an impact on costs - ETS has dominant impact in the early period. Although it has limited impact on fuel choices, can still raise significant revenue for Innovation Fund. Later on costs of FuelEU are more significant as operators switch to clean fuels.
- NB: not all costs are included here. Additional costs e.g. port fees, maintenance that may be more constant between scenarios are not modelled.

Rise In Costs Appears Manageable When Factoring In Demand Growth



Source: T&E containership fuel optimisation model (2023). FEUM pathway, base-case fuel price assumption. Analysis does not include other costs such as investments in energy efficiency, or other OPEX.

Final FEUM pathway

- Weighting by containership transport work (TEU-nm) shows more moderate increase in costs.
- Initial decline in fuel costs (through LNG switching) is not outweighed by increased costs of using low carbon fuels until 2045.
- Slow ramp-up in required share of low carbon fuels means that fuel prices are likely to have declined by the time large volumes are needed under FuelEU.